Zürcher Hochschule
für Angewandte Wissenschaften

School of Engineering
IEFE Institut für Energiesysteme und Fluid-Engineering

Optimal Sizing Tool of Battery Energy Storage System for Local Load Shifting

Introduction

This tool is an algorithm for determining an optimum size of Battery Energy Storage System (BESS) via the principles of exhaustive search for the purpose of local-level load shifting including peak shaving (PS) and load leveling (LL) operations in the electric power system. An exhaustive search method is employed to perform the BESS capacity (Q_{ESS}) and power (P_{ESS}) optimization. The sizing process involves two distinct steps. In the first step the search for a feasible BESS parameter space in which the requirements of PS and LL are fulfilled and in the second step the search for an optimum point in the feasible space with respect to the cost benefit. Finally, the search is expanded to find a set of storage capacity, Q_{ESS} and peak power limits, Plimit's for each month, in order to perform the load shifting throughout a one year.

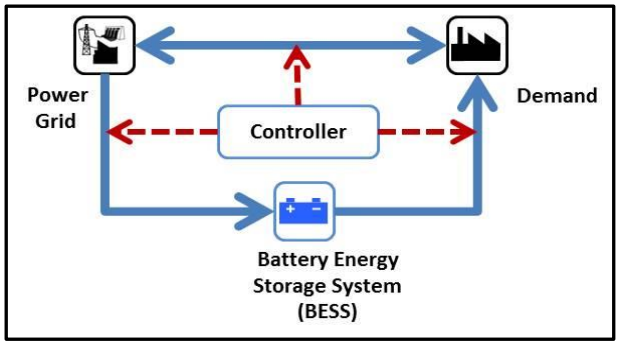

Figure 1. BESS sizing configuration

Results

To validate the BESS size optimization, an appropriate model is created for time-domain simulations. The model consists of variable load, a simple state-space BESS model and a rule-based controller which operates the BESS using a set of rules. A number of time-domain simulations were performed to validate the correctness of the BESS size optimization. It is demonstrated that the proposed optimization algorithm produces results that meet the requirements in the peak shaving and load leveling operations.

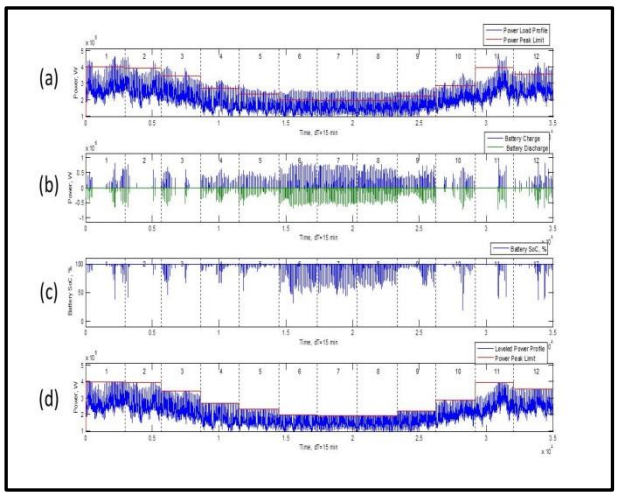

Figure 2. Result of peak shaving (PS) process with a sized BESS: (a) Power Load Profile and Plimit for one year before PS; (b) Charge and discharge of BESS; (c) State of Charge (SOC) of BESS; (d) Power Load Profile and Plimit for one year after PS.

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